TRAFFIC ENGINEERING

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THE INTERMEDIATE INTERVAL IN STOP AND GO SIGNALLING

by GUY KELCEY AND IRVING MACK

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WHAT DO TRAFFIC SIGNALS MEAN?

"On March 25 the Chairman of the Concord, N. H., Police Commissioner was fined $3 for passing a traffic signal while both green and amber lights were showing. The Concord ordinance says that drivers may go only on green signal. The sequence is Green, Green-Amber and Red. A Concord citizen 'can't see any sense in having both green and yellow showing at the same time. Green always means Go!' " — *American City*

UNIFORM usage, understanding and enforcement of traffic signal indications is highly important. In the early days of traffic signalling, some officials insisted that national standards require all traffic proceed north and south on the green signal and east and west on the red. If their views had prevailed, great confusion would have resulted and the present simplicity of traffic control signalling would be impossible.

While major confusions were thus avoided, other quite important ones persist or have developed. The use of a red signal indication, not only for "Stop" but for the intermediate interval, during which movements occur against the red within intersections, is an example. If the absolute stop requirement of red is to be preserved, its use alone or in other color combinations, for intervals which permit movement within an intersection, should be avoided.

The proper use of the immediate interval, following the green signal indication, has also been confused in a number of jurisdictions by combining the usual amber indication with green or red to provide various meanings and shades of meanings known only to local users and not always to all of them.

Such special color combinations do harm in that they confuse proper and standard use of red and green for "Stop" and "Go." They are both confusing and dangerous where they can be mistaken by strangers for the usual clearance interval, whereas locally they signify something else or vice versa.

The intermediate interval is quite properly intended to provide clearance time for pedestrians, caught midway between curbs, and for vehicles in, or outside of, but entering or closely approaching an intersection from "Go" directions. The best and major use of this interval is to permit these pedestrians and drivers to clear the intersection and to attain a place of safety on the far side before cross movements are started.

The need for the timing of three seconds, often allotted to the intermediate interval, is confirmed by the following analysis:

If, when the "Go" interval is ended, a driver is too near the intersection to stop quickly, particularly in bad weather, enough time must be allowed so that he may continue through before cross traffic is released. The time necessary to provide for such cars is indicated by the following table, which is based on forty foot width of cross roadway:

Speed Miles Per Hr.	Total Safe Braking Dist.	Total Safe Braking Distance Plus 40 Feet	Speed Ft. Per Second	Intermediate Interval Needed In Seconds
20	44	84	30	2.8
30	83	123	45	2.74
40	132	172	60	2.87

From this it is apparent that a car moving 30 miles an hour requires 83 feet to make a safe stop, particularly in wet weather. If the driver, moving at 30 miles an hour, is within 83 feet of the "Stop" line, the three second intermediate interval, between the green and red indications, gives him time to traverse this distance plus the 40 foot pavement on the cross street before the opposite movement starts. The measure of the intermediate interval is, therefore, "time," based on width of cross street and speed limits for the intersection.

In most parts of the United States the standard or accepted use of the intermediate interval conforms to the clearance analysis above. In some jurisdictions, however, the intermediate or amber interval is treated by enforcement officers, not as a clearance interval, but as a prohibition of movement requiring an instantaneous stop, and on this basis arrests and fines are regularly made for violations. This amounts to an abuse of this entirely reasonable, necessary and proper interval.

If the "Stop" and "Go" signal is to survive as an effective instrument, it must be used as intended, and so enforced—the intermediate interval cannot safely be eliminated or its use abused. If a driver from one state understands that the intermediate interval means an instant stop and a driver from another understands and uses it as it is normally intended, skids and rear-end collisions are an inevitable consequence.

It is equally necessary that vehicles, stopped by the red signal, do not start during the intermediate interval but that they be required to await the green. This is best accomplished by continuing the red signal in one direction through both the green and amber intervals in the opposite direction. The amber is not shown after red but only after green.

Traffic signaling, if it is to continue useful, must be kept clear of the confusions so prevalent in enforcement of many other traffic laws and regulations so that a driver often does not know when the law is the law. Drivers must not be interfered with by law enforcing officers in their proper use of the intermediate interval in "Stop" and "Go" signaling lest the value of this safeguard be lost. It is equally important that the use of red or of combinations of signal colors to indicate the intermediate interval be avoided or necessary simplicity of color meanings will be confused and important values will be disturbed or lost.

SPEED ZONING IN MINNESOTA

by W. F. ROSENWALD, *Traffic Engineer*
Minnesota State Highway Department

THE question of proper speed limits on our streets and highways is a much more difficult one today than it was a few years ago. Not so long ago the speeds of motor vehicles were automatically restricted by the inherent mechanical limitations of the vehicle itself. We need not be very old to recall the time when the speed of a car upon a good road was scarcely more than ten miles an hour above the speed that car could travel on a poor road. Under such circumstances the principle of a single speed limit applicable to all roads without regard to varying conditions presented few difficulties.

Things are much different today. Better and faster cars and better roads have brought about a rapid increase in traffic with a spread of 50 miles an hour between the fast and slow traffic. Thus a fixed speed limit no longer is reasonable and the old speed laws are recognized as being obsolete.

With the improvement of vehicle and highway came also public recognition of the demand for faster travel and of the dependence of commerce and industry upon these greater speeds. Thus grew the general realization that speed limits should be variable, depending upon the condition of the road and the nature of the traffic upon it.

Prior to the spring of 1939, the laws of the State of Minnesota provided for a prima facie limit on all rural highways of 45 miles per hour, with the authority vested in the Commissioner of Highways by the 1937 legislature to increase or decrease any existing limits if, after an engineering and traffic investigation, he found such changes to be desirable. Under this provision and after doing considerable experimental work on a single stretch of road of approximately 175 miles, the necessary investigations were begun for the zoning of the trunk highway system. At the end of 1938 approximately 2,000 miles of the trunk highway system were zoned for maximum safe speeds.

The 1939 session of the legislature changed the speed laws in several respects, one of these changes being the raising of the prima facie speed limit in rural areas from 45 miles per hour to 60 miles per hour in the day time and 50 miles per hour during the hours of darkness. With this change in the law, the need to zone the open stretches of rural highway where higher speeds were not unreasonable was somewhat lessened, so that during the past year speed zoning activities have been restricted to those areas where some speed restriction was necessary. In other words, there has been practically no zoning at 60 miles per hour during the past year.

The procedure used in zoning is as follows:

The various routes are subdivided into sections having similar conditions. From information available from traffic census or from records of the Highway Planning Survey, the average daily traffic is determined and from our accident reporting records the accident experience, based on vehicle miles, is computed for each section.

In any study of the speed practices on a highway for the purpose of determining the proper speeds, it is highly desirable to know at what speed the bulk of the traffic is moving. This information as to actual speeds has been obtained through the use of a Reich speedmeter. In developing the information obtained in this manner, little or no attention is paid to the so-called average speed as it is not felt that the average speed is an important criter-

ion. It has been found more desirable to determine the speed at or below which 85% of the traffic is moving, and also the speed at or below which 20% of the traffic is moving. The pace of the traffic has been defined as the 10-mile speed range containing the largest number of vehicles. It is more important to know what the pace of the traffic is than what the average speed is. As a general rule, if the accident rate is comparatively low and the physical conditions on the road permit it, the speed limit is set at or near the upper limits of the pace. If the route in question has a rather high accident rate, the limit is decreased but the established speed limit should always be within the limits of the pace if such limit is to be observed without the need of an excessive enforcement program.

After these investigations and studies have been completed, test runs are made over the road to determine the practicability of the proposed speed limit. On horizontal curves the test run is made with a vehicle equipped with a mercury tube device developed in the Department, which is calibrated to measure the side thrust at various speeds.

At the end of 1939 there were approximately 2,500 miles of trunk highways zoned for maximum safe speeds, practically all of the new zoning in 1939 was restricted to those stretches of road where speed restrictions were necessary.

It was formerly the custom to use a "Begin Speed Zone" sign to indicate the beginning of a speed zone, and since the entire length of the highway was being zoned it was not necessary to terminate any particular zone except through the use of some zone sign for a new limit. Speed zone signs carrying the word "Begin" have resulted in some confusion. It also appears that the variation in the wording on a sign to distinguish the beginning of a zone from a confirmatory sign within the zone is neither necessary nor desirable. Present standards, therefore, provide for only one sign carrying the message "Speed Limit" in addition to the figure indicating the proper limit.

Since new zoning is largely restricted to those areas where a reduced speed is required, it is necessary under the Minnesota law to terminate the restricted zone through the use of a sign "End Speed Zone." Under existing laws, if the zone were not terminated it would continue until confirmed or changed by the next speed zone sign.

TRAFFIC SAFETY SURVEYS FOR CITIES OF MODERATE SIZE

by DWIGHT M. MCCRACKEN

IN the earlier stages of motor car development only large cities were affected by traffic difficulties. However, the remarkable development of the automobile, coupled with a corresponding improvement and expansion of our highway systems has brought to *every* community, large, medium, or small, a traffic problem of its own.

Statistics show that in a great many cities of from 50,000 to 250,000 population the ratio of motor vehicle registrations to population is higher than in the larger cities of over a quarter of a million. Add to this heavier per-capita motorization the large number of vehicles brought to and through the district by good interconnecting highways and some idea may be had of the amount of automotive travel to which the average moderate size community is subjected. When we consider that during the peak hours much of this traffic is concentrated in a central business district smaller in proportion of total area than that of large cities, it is little wonder that problems of congestion

and accident exist.

The average city in the size range just mentioned, that is, from the size of Pittsfield or Brockton, Massachusetts, up to and including cities the size of Worcester, Massachusetts, or Syracuse, New York, has about *13* traffic deaths per 100,000 population. It has been found, again using national average, that for every fatal accident there are 35 personal injury accidents and 150 property damage cases and that the economic loss from *all* these mishaps is $45,000. By rough calculation then, we see that the *average* city of moderate size suffers about 20 fatals, 700 personal injury and 3,000 property damage accidents each year at a total cost to the community of close to a million dollars!

In an effort to throw off, or at least *minimize*, this accident burden, more and more cities are turning to a scientific, factual approach for the solution of their complex traffic problems. The day is past when untried devices and guesswork have to be relied upon for curing traffic ills. Today scientific principles and proven techniques developed by professional traffic engineers are available to all local traffic authorities who wish to use them. However, since this service is mostly advisory and must be based on facts gathered locally, it is important for local officials to know how to find and analyze their problems and *what* facts to gather for their solution. This calls for a knowledge of traffic safety survey methods and forms.

Where a complete traffic survey is to be undertaken it is highly desirable that it be sponsored by a suitable group. Thus, the selection of a committee or commission to cooperate with the technical staff is one of the first considerations. This need exists whether the survey is financed by public or private funds. The membership should be selected from public agencies such as police, fire, public works and park departments; from civic agencies such as chambers of commerce, automobile clubs, safety councils and improvements organizations; and from private commercial organizations such as insurance groups, retail trade associations, street-railway and bus operators, property owners, taxicab operators, and trucking concerns.

In addition to the accident analyses and studies of physical conditions at high accident locations, it is generally necessary to study the volume and direction of foot and wheel movements over the street system and particularly at these danger points. A knowledge of the prevailing speeds approaching and passing through hazardous areas is also important. Finally, the behavior of drivers and pedestrians as to their observance of traffic signal indications and other safe traffic practices helps to determine the proper solutions.

As can be seen, the whole object of these studies is to discover the most prevalent cause, or combination of causes, which is *directly responsible* for accidents at a given point, or when combined and summarized throughout the entire city. With this determined, the traffic authority should be able to decide what remedies are necessary and practicable.

There are all types of cities—agricultural, industrial, residential, and resort. Each type has its own special problems. For this reason, it cannot be expected that all of the studies advanced will fit every problem that might arise. But it is hoped that they will provide a valuable working basis upon which officials in charge of traffic may rely for guidance. It is further hoped that these same officials will cultivate an increasing interest in traffic safety surveys in order that more and more of our problems may be solved successfully through a factual, scientific approach.

242. *Condensed from a paper presented by Dwight M. McCracken, Director, Traffic and Safety Bureau, Liberty Mutual Insurance Co., (Mem. I.T.E.), before the Traffic Engineering Session, Annual Mass. Safety Conference, Boston, March 11, 1940, 7 pages.*

THE ENGINEER'S JOB

by HAWLEY S. SIMPSON

THOUGH traffic engineering, as a profession by that name, is hardly more than 15 or 20 years of age, there are today between 30 and 40 city traffic engineering departments serving a total population of more than 25,000,000. Other governmental and non-governmental organizations availing themselves of the techniques of traffic engineering include: state highway departments, state motor vehicle departments, state police departments, county highway offices, park districts, automobile clubs, transportation companies, insurance companies and safety councils.

The function of the traffic engineer, stated quite briefly, is to improve the utility and efficiency of our street and highway system through the application of engineering techniques developed especially for that purpose.

Competent traffic authorities universally endorse the principle that the highest degree of traffic safety cannot be achieved in the absence of engineering studies and the application of recommendations resulting therefrom. Traffic engineers have developed an impressive record of improvements which have resulted in accident reduction at specific locations. Most gratifying is the fact that costs have, in every case, been outweighed many times by the direct monetary saving to the public in accident reduction, without considering in any way the resultant lessening of human misery and suffering.

The Institute's function in the traffic field is essentially one of advancing the techniques of traffic engineering and encouraging their wider adoption so that traffic everywhere may move more efficiently and with less hazard. In accomplishing these objectives, the Institute engages, through the voluntary cooperation of its members, in numerous technical and semi-technical activities. Some of those currently in progress which should be of general interest to everyone concerned with traffic are the following:

1. The development of modern standards defining the desirable quantity and quality of street lighting for streets and highways, in cooperation with the Illuminating Engineering Society.

2. The development of standards and specifications for traffic signal units, traffic signal controllers, and pedestrian control signals, as a preliminary to the adoption of such standards by the American Standards Association.

3. At the invitation of the International Association of Chiefs of Police a joint committee of that association and the Institute has recently been established to decide upon workable criteria for determining when and where stationary traffic officers should be assigned to intersection duty.

4. The preparation of a book to be entitled *Traffic Engineering Handbook*, sponsored jointly by the Institute of Traffic Engineers and the National Conservation Bureau. Leslie J. Sorenson, Past President, ITE, and Harold F. Hammond, Secretary-Treasurer, ITE, are acting as joint editors of this book which is scheduled for publication early in 1941. Assisted by a board of associate editors, it is planned to bring together in readily usable form all essential data and information which should be at the disposal of traffic engineers.

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243. *Condensed from an article by Hawley S. Simpson, Research Engineer, American Transit Association, (Mem. I.T.E.)* PUBLIC SAFETY, *April* 1940, pp. 20-21, 41.

TESTING VISIBILITY OF HIGHWAY SIGNS

by MILES S. KERSTEN

THE rapid increase in night accidents on highways has led to an intensive study of factors relating to their cause and means of cure. In recent years there has been a much greater increase in night fatalities than in daylight ones, and poor visibility has proved to be one of the most important single contributing factors. Fixed highway lighting has been one of the methods advanced for providing safe seeing, but it will of course prove economical on only a small percentage of the highways; elsewhere the driver must continue to depend solely on his automobile headlamps.

One of the factors of safe seeing is the visibility of highway warning signs. Various improvements have been incorporated in these to make them more visible at night. Rating of the effectiveness of various types has thus far been based largely on personal impressions of quality of visibility rather than on a definite measurement, mathematically expressed. It was to develop a method, the results of which could be expressed in numerical terms, that the study described in this article was made. Briefly, the tests consisted of illuminating different signs at set distances with a set of headlamps and taking quantitative measurements of visibility with a Luckiesh-Moss visibility meter.

The visibility meter consists essentially of two colorless photographic filters with precise circular gradients of density. The filters are mounted in an enclosing frame so that they can be held up to the eyes and rotated simultaneously by a small wheel operated with one finger. The instrument is held to the eyes and the disk slowly turned until the object or detail being observed is just barely visible, or at the "visual threshold."

The meter is equipped with two scales, one of which reads "relative visibility." The range on this scale is from 1 to 20. In the original construction of this instrument a simple calibration procedure was used to establish these points. A standard object under standard lighting conditions was viewed through the instrument and the filters turned until it was just visible; this portion of the gradient filter was assigned a value of "1." A value of "2" would mean that an object was twice as visible, or had twice the area, when observed under like conditions. Other readings have the same relative significance.

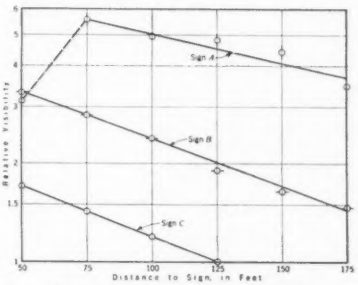

FIG. 1. RESULTS OF TESTS ON RELATIVE VISIBILITY OF THE WORD "STOP" ON THREE TYPES OF SIGN
The Headlights Were on High Beam for the Observations Plotted Here

The tests clearly indicated a wide variation in the visibility of various types of signs. This fact is well shown in Fig 1, a typical plot of a set of results on three different "Stop" signs. All three of these signs were the regular octagonal signs, 24 in. high by 24 in. wide. Sign "A" had white, 9/16-in. reflector buttons on the letters of the word "Stop"; there were no buttons on the border. Sign "B" was covered, except the area of the letters, with glass beads, 0.02 in. in diameter, which adhered to the yellow paint of the sign; the letters of the word "Stop" were painted black as in the other

signs. Sign "C" was a plain painted sign. Tests on these same signs for reading "Stop" with the low headlamp beam, and for merely noting the presence of the sign with both the low and the high beam, gave sets of curves similar to Fig 1 for the high beam, plotted on a semi-log scale. Tests were also run on "arrow" turn signs, and a like variation for different types of signs was found.

Each point of Fig. 1 represents the average result of 15 readings, 5 each by three different observers. Quite uniform results were obtained after some experience with the meter had been acquired. It will be noted that the relative-visibility-distance relationships shown tend toward straight-line plots on a semi-logarithmic scale. This characteristic was common to all signs tested.

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244. *Condensed from an article by Miles S. Kersten, Instructor of Highway Engineering, Univ. of Minnesota,* CIVIL ENGINEERING, *April* 1940, *pp.* 225-226.

SEEING AND TRAFFIC SAFETY

by NELA PARK ENGINEERING DEPARTMENT
General Electric Company

MILLIONS of automobiles upon our modern streets and highways make life and death a matter of split-second seeing. It is more than a community or even a national problem; personal safety is a matter of prime importance to every individual.

Studies have shown that lack of visibility is a major cause of night traffic accidents. Yet we have lagged greatly in the development and utilization of adequate seeing tools. This has been due to a lack of fundamental knowledge of the many complex factors affecting the operation of the human seeing-machine.

More recently the new knowledge of the Science of Seeing is being used to attack the problem of safe seeing on two fronts—by means of the portable lighting system carried by the automobile, and the fixed system provided by street lighting. The former must be relied upon for illuminating by far the greater amount of our road mileage. The latter is of particular importance on urban streets and on a limited but very important percentage of main highways, where a high degree of visibility is imperative for safety and comfort after dark.

Extensive investigations of driver attention characteristics, glare effects, and time requirements have shown the need for headlighting vastly better than past practice. The culmination of this work has been the development of the new Sealed Beam Headlamp. With its greater efficiency, controlled candlepower and almost complete lack of depreciation it marks a significant milestone in the progress of automobile head lighting.

In a similar manner, five years of research into the reflection characteristics of pavements and obstacles, and the effects of static and fluctuating glare conditions have provided a basis for the development of the new luminaires with which streets and highways may be lighted efficiently and effectively.

The new quantitative knowledge has made possible a comprehensive, technically adequate method of street lighting evaluation. The latest development is the General Electric Street Lighting Evaluator, with which field measurements can be carried out simply, quickly, and accurately.

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245. *Condensed from a 24 page booklet prepared by the Nela Park Engineering Dept. of the General Electric Company. LD-9 price 20 cents.*

THE RESPONSIBILITY OF THE INDIVIDUAL

by WILLIAM JUNKIN COX

AS an engineer I would speak to you about the contributions that engineering design should make to the safety of streets and highways.

I think it is important to emphasize to you the *limitations* on what the engineer can do, and to point out the responsibilities that the individual highway user must accept, and why he must accept them.

In adopting this negative approach to the work of the engineer in connection with street and highway hazards, I do not mean to imply that the engineer is without important safety responsibilities, nor do I mean to suggest that as highway commissioner I am not interested in doing every thing feasible to build safe highways and to maintain them safely. The state highway department is doing a wide variety of things to make our roads safe — *for any given rate of speed*. But that is all the engineer can do. The very things which make a road safer for a given speed also by their nature make possible *a higher speed*. The road user can have more safety at the same speed or more speed with the same safety—or still more speed with less *safety*. And he often chooses the latter.

To clarify the relation of the highway engineer to the safety of the roads he builds let me ask you how many accidents—as you think of highway accidents — occur on unimproved "dirt" roads. The number is negligible. The reason is obvious: when a road is sufficiently bad, people are simply unable to travel at the speeds at which drivers lose control of cars, or at which drivers have not adequate time to react properly to a potential accident situation as it develops. Practically no one is killed on dirt roads.

Usually the first step in the improvement of such a road has been to smooth out the road bed and apply a treated gravel surface to permit year-round use—not much expenditure being made for widening road surfaces, constructing good shoulders, and especially to lengthening out sight distances by flattening curves and leveling grades. The road, in other words, remains a low or moderate speed road, and serious accidents on it continue to be infrequent.

As the traffic on such a road increases and demands a "better" facility —by which traffic means (whether it fully realizes this or not) a "faster" road— the alignment of the old road is straightened, grades are reduced, the road surface is widened, and smooth shoulders are added. The road, in short, is made much safer *for the same speed*; but in doing that, it is also made capable of being traversed *at a much higher speed*.

Invariably the bulk of the public chooses, either immediately or more gradually, to use the improvement for the second purpose—more speed.

Many roads have been rebuilt in this state and in other states on the plea that the old road was crooked and dangerous. The plea may have been made in all sincerity — doubtless in most cases it has been. But the human race has enormous capacities for self-deception—"rationalizing," I believe the psychologists call it—and it is my considered opinion that in very many of these cases the real, though perhaps hidden, source of dissatisfaction with that old, crooked road has been that it did not permit *as fast travel* as the users of the road wanted.

Speed may or may not be the immediate cause of many automobile accidents—but it sets the scene for the

serious ones. Generally speaking, improvement of our roads can give us *more speed* or *more safety*—but not both, for the two are antagonistic.

Whether he wills it that way or not, it seems to be the destiny of the highway engineer not to build *safer* roads; it seems to be his function to build roads that will as nearly as possible maintain the existing safety level under the increased speeds that the road improvement has made possible and that the road users choose to employ.

The Merritt Parkway is often cited as an example of how safe a road can be made. Grades are separated; opposing lanes of travel are divided by a wide strip, planted where necessary to decrease headlight glare; sight distances are ample throughout, curves are flat, and are carefully banked. Practically everything that the science and art of traffic and highway engineering can provide to make a road safe has been provided, and the accident experience has been very satisfactory.

But in addition to the engineering features of the road, note this: speed on the road has been limited to fifty miles an hour (which is no more than the speed permitted on the highway system generally) *and the road is patrolled night and day to see that the speed limit is observed*. The Merritt Parkway constitutes less than one and one half per cent of the state highway system of Connecticut, but it absorbs about 25 per cent of the state police patrol of the highways.

How safe do you think the Merritt Parkway would be if it were not patrolled? With the fifty mile speed limit that is now in force, it is incomparably the safest road in the state. I said previously that improvements in a road can make it much safer *for a given rate of speed*, and here is a good illustration.

When the highway engineer has gone just as far as he can go and assuming that he has done a 100 per cent job, the result of his work will be a safe road or an accident-studded road—*depending on the use that is made of it*. That use is determined, in the last analysis, by the travelers upon the road. That is what I mean by the responsibility of the individual.

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246. *Condensed from a paper given by W. J. Cox, Highway Commissioner, Conn. State Highway Department, at Conference on Highway Safety, Yale University, New Haven, Conn., March 27, 1940. Mimeographed, 6 pp.*

NARROW STEEL DIVIDER MAKES STREET SAFER

by R. T. Dorsey

RAMONA Boulevard, in the city of of Los Angeles, leading immediately out of the downtown traffic area, was completed as a four-lane highway on April 20, 1935. There are no traffic crossings, at grade, although a number of bridges that rest partially on pillars at the center line of this street have been constructed.

Because of lack of vehicular cross-traffic, speeds are exceptionally high, averaging between 45 and 50 miles per hour and resulting in a serious accident history. From the date of the opening until August 17, 1938, there were 58 personal injury accidents. Of the accidents noted, 69 persons were injured and 8 killed. Most of the serious accidents were caused by head-on collisions, sideswiping, and driving into bridge abutments.

These facts indicated that a definite division of the roadway and the guarding of the center bridge abutments would have a remedial effect by making it impossible for traffic in opposite directions to conflict, and would also

protect the center abutment.

Ramona Boulevard being bounded on one side by the Pacific Electric tracks and on the other side by very high hills, it was not possible to provide a wide neutral center zone. Furthermore, this method would have been very expensive and would have taken a long time because of delayed condemnation proceedings. Another problem was that, since the lanes were not as wide as those now marked on state highways, *it was necessary to find a satisfactory divider that would not take up more space than the two white center lines.*

The separation was accomplished by taking two roadside guards and installing them back to back, using one post for mounting the two required brackets. The rails are 12 inches wide, convex in shape and fastened to spring-steel, heat-treated brackets which are attached to the post near the ground level and are so formed that the two rails are approximately 5 inches apart. Because it was necessary to use as little road space as possible, the manufacturer developed a heat-treated spring steel post 4 inches wide and taking up only ¾-inch road width. A special analysis spring steel, with a tensile strength of 165,000 pounds per square inch, was used. The special treatment of the posts gives great shock-absorbing assistance to the double-acting spring steel brackets on which the rail is suspended. These features give extreme resiliency and deflective action, allowing great absorption and diversion of shock, with minimum danger to passengers and to the vehicle itself. The convex rail presents a smooth surface at hub-cap height and is installed in sections of 12-foot centers on straight roads and 10-foot centers on curves.

To safeguard against any danger to night traffic, blinker lights were installed every 110 ft. The inside of the convex rail plate provided for an easy installation of the electric cable and of the bracket for the lights themselves. Also to provide for greater visibility at night, the rail was painted with alternate black and white stripes, the white portion being covered with small spheres which reflect the rays of headlights. On the straight stretch a regular aluminum paint was used with the blinker lights 100 feet apart.

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247. *Condensed from an article by R. T. Dorsey, Traffic Engineer, Los Angeles, California,* (Member I.T.E.), AMERICAN CITY, *April,* 1940, *p.* 117.

AERIAL MOTION PICTURES AND TRAFFIC ENGINEERS

by MILTON HARRIS

ACCIDENTS within the traffic stream are very often caused by malignant driving habits. The isolation of these habits is often difficult. Present in any traffic stream, they are revealed only by close study and analysis.

The safety department of the California division of highways recently completed an experimental photographic test. A 16-mm. motion-picture camera was sent aloft in the vicinity of Los Angeles. The camera was attached to a captive ballon and was controlled from the ground. The Goodyear Tire and Rubber Co. and the Bell and Howell Co., camera manufacturers, cooperated with engineers of the safety department in devising the necessary equipment.

A small motion-picture camera, equipped with a wide-angle lens, was mounted in an aluminum frame to which was attached a solenoid and

plunger connected to the shutter release and actuated by a power supply on the ground. An 11-foot spherical balloon was filled with helium gas and the camera so mounted that it swung free with its lens normal to the ground. Two bronze guy wires, in addition to a main steel cable which controlled the elevation of the balloon, were used to hold the bag in position over the road, and as transmission lines for the current that actuated the shutter release.

The balloon was anchored in such a manner that the lens framed a good portion of the intersection to be photographed. The ground crew was out of sight of motorists. The traffic observer was enabled to operate the camera by remote control at any desired time.

Motorists were closely watched to see if their attention would be attracted to the balloon floating overhead. Its height was such, however, that it was not a source of interest to drivers. No change in the manner of driving was apparent.

The results fully justified the experiment. The intersection was well framed and the pictures were clear. Density and speed checks are easily obtained by this method. For determination of vehicle paths, aerial photography is the most practical method so far devised. Three or four clear frames are sufficient to plot the path of any machine within the area covered by the lens. Types of vehicles are easily ascertained. Traffic violations may be detected, especially when the film is viewed through a hand-operated "editor," where it can be stopped and studied at any desired point. Pedestrian interference may be readily broken down into behaviors for analysis. Location of impediments to lines of sight are easily obtained from the air.

Modernization of survey equipment and methods should engage the attention of all traffic engineers. The latest equipment should be made available for that most modern profession—traffic engineering.

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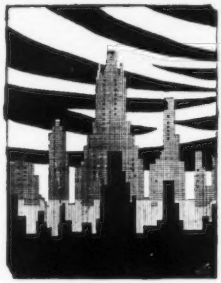
248. *Condensed from an article by Milton Harris, Associate Highway Engineer, California Division of Highways,* ROAD BUILDERS NEWS, *March, 1940, pp. 6-7.*



Traffic Engineering NEWS

Eastern Region Banquet

The most significant aspect of the Highway Safety problem today is that the state highway systems are trying to carry two and one half times as much traffic with about one half as much money per mile for the rebuilding and maintenance of roads as they had 10 years ago.

This was the highlight of the address made by Thomas H. MacDonald, Commissioner of the Public Roads Administration before the eastern region dinner of the Institute of Traffic Engineers. Hawley S. Simpson, President of the Institute presided.

A feature of the Institute's dinner was the announcement by John W. Darr, Director of the Commercial Investment Trust Safety Foundation that the award for the outstanding commercial film featuring traffic safety would be presented in Cleveland, Saturday, April 20, by the Foundation to the Cleveland Railway Company and Cleveland Safety Council which jointly sponsored the film, "You Bet Your Life."

"We are not only increasing the registration of motor vehicles in numbers but we are increasing the use of those vehicles on the state highways. At the same time those vehicles travel at a higher speed than they did 10 years ago," Mr. MacDonald said.

"If we take 1925 as a base, highway usage measured by gasoline consumption jumped 240 per cent up to 1939. The gasoline use per vehicle has increased by 55 per cent since 1925.

In 1930 and 1931 the state highway departments had an average of about $1700 of income per mile of road under their jurisdiction. Since then a great many county roads and local streets have been transferred to the state's jurisdiction. The mileage under state jurisdiction was 325,000 in 1931; this increased to 540,000 in 1938.

"In 1938 the states had just a little more than one half the money per mile to take care of the highways that they had back in 1930 and 1931. The motorist meantime is paying more in highway taxes today than he did 10 years ago.

"So we have a situation marked by increases in the number of vehicles, in the mileage traveled for each vehicle, and in the speed of such vehicles, confronting a situation in which tens of thousands of highway miles have been added at the expense of the state, while funds available to the state for taking proper care of such highways per mile has been drastically reduced."

The surprise feature of the evening was an unexpected visit by a Russian Commissar of Traffic and Transport. He gave a vivid description of his reaction to traffic engineering and traffic conditions in this country after having made a detailed survey of two long days. His talk was interrupted by a guest at the banquet who could not stand the jibing directed toward the American way of doing business.

P. S. The Russian was cleverly portrayed by Mr. Ernest Hapgood, Jr.

Flint's Traffic Engineering Department

In the fall of 1938, the city officials in Flint realized that something had to be done with the city's traffic control devices, and definite plans made to cut down traffic accidents and to eliminate causes of congestion. Until this time, the Traffic Division of the Police Department had been trying to take care of the traffic control devices on a very limited budget, and the Department of Public Works had submitted plan after plan of new street and bridge designs to improve the arterial highway system of the city, but had not been very successful in any of their endeavors.

On March 1, 1939, Flint's Traffic Engineering Division was set up in the Police Department with a Traffic Engineer, electrician, and sign erector. The latter men were formerly members of the Traffic Bureau. Today, a year after the inauguration of the new division, the Traffic Engineering Division has ten men, including a secretary, draftsman, two electricians, parking meter maintenance man, two sign erectors, painter, and laborer.

The first job that the Traffic Engineer had to do was to supervise the installation of 500 parking meters, and 8 or 9 months after, the installation of 200 more, giving the city 700 parking meters to date.

Flint has been endeavoring to finance its governmental services with a 15 mil limitation tax, of wich 9 mils went for school and debt services, leaving approximately 6 mils to carry on all the other city services. It was no wonder that Flint's traffic control devices had depreciated to the point that signs and signals were rusty, markings obliterated, and the whole system fallen in disrepair.

Another day has come, for all the revenue from parking meters has been diverted to the rehabilitation of traffic control devices. We have had $30,000 to buy new stop signs, parking prohibition and restriction signs, and other traffic control devices; money for intersection re-design, street lighting, and equipment to carry on construction activities of the division. It will probably take a year and a half to two years to change over nearly 6,000 signs to conform to the specifications as set forth in the Manual on Uniform Traffic Control Devices.

The Traffic Engineering Division has completed approximately $90,000 worth of work in its first year. This includes $33,000 for installation of parking meters, $30,000 on the traffic improvement program, $16,000 for traffic signal installation on trunk line highways, and $10,000 on the regular budget for the general maintenance activities of the Traffic Engineering Division.

I believe that the Traffic Engineering Division has set a record for the city of Flint. There has been only one fatality in 1940, compared with seven fatalities for the same period in 1939, and a proportional decrease in personal injury and property damage accidents.

Wanna Job?

The newspaper of a not too unimportant city, largest in its state, recently reported on a meeting of the city's Traffic Commission, as follows:

"No mention was made of the appointment of a full-time city traffic engineer, a proposal which has been hanging fire since the final meeting of the old traffic commission. The Mayor has indicated he favors employing a young graduate engineer with some *ability at draftsmanship and who would be able to supervise street striping and similar work.*"

Line forms on the right — come equipped with paint brush and pail.

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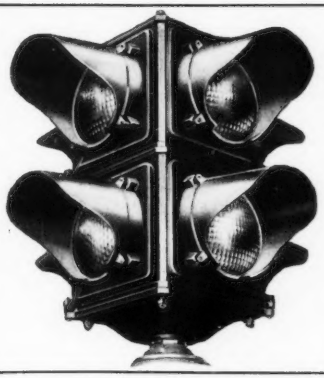

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1939 PROCEEDINGS

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Wanted—Traffic Exhibit

The National Conference on Planning, to be held in San Francisco in July, is collecting material suitable for exhibit purposes in the general field of city and traffic planning.

We have been asked to call this project to the attention of our members and request their cooperation.

Among the subjects to be included in this general exhibit are the following:

1. Highway Planning
2. Traffic Planning
3. Transit
4. Traffic Engineering

Members of the Institute who have material on these and related subjects which they would like to have exhibited at the Conference, should correspond immediately with I. S. Shattuck, Mem. I.T.E., who is Chairman of the Steering Committee for the Conference.

Arkansas State Highway Commission

Mr. H. D. Booth, supervisor of the traffic and safety division of the Arkansas State Highway Commission, of Little Rock, completed during January presentation of a course for highway department employees entitled "Principles of Traffic Engineering." The course, patterned after the National Institute for Traffic Safety Training and requiring thirty hours of actual class session, was attended by twenty-five employees of various divisions of the department.

Mr. Booth writes: "As you may readily imagine, this course did much to bring about a better appreciation of traffic engineering functions. We plan a similar but greatly expanded course running both semesters of our In-Service Training set-up to begin in the fall."

Mr. Booth recently spent a week with city officials of Fort Smith, Ar-

kansas, studying city traffic problems, during which time he conferred with the mayor, city commission, and police department on organizing a traffic division and instituting up-to-date methods of traffic law enforcement.

155 Cities Use Parking Meters

At least 155 American cities now use parking meters to regulate parking in congested business and residential areas, the International City Managers' Association reported today. Approximately $3,470,000 was obtained from meters in 1939 by 102 of the cities—those reporting revenue figures to the Association.

The report, to be published soon in the 1940 Municipal Year Book, shows increases in the use of parking meters since 1935, when Oklahoma City made the original installation. Dallas and El Paso also adopted the meters that year.

Since then, the use of parking meters has grown rapidly. Seventeen cities installed them in 1936, 29 cities in 1937, 35 in 1938, 55 in 1939, and 16 cities during the first two months of 1940. Four cities — Topeka, Kan.; Bristol, Va.; and Lubbock and Tyler, Tex.—reinstalled parking meters after having once abandoned them. Meters have been abandoned completely by nine cities, however.

Three-Purpose Billboard

A three-purpose billboard, announced by a Minneapolis company will display an advertisement, warn the driver that he is approaching a dangerous intersection and tell him at what speed he is travelling—provided he is doing 30 miles or more. Night illumination will be turned on by magnets under the road, which also will actuate the speed calculator.

The nearer the billboard is placed to the intersection the more truth there will be in its announcement that the intersection is dangerous.

1940 Program Committee

President Simpson appointed George Barton as Chairman of the Program Committee and Robert A. Mitchell as Vice-Chairman. Mr. Barton and Mr. Mitchell will be assisted by four subcommittees as follows:

Sub-Committee for Sessions

Robert A. Mitchell, Chairman
John H. Hunter, II
Burton W. Marsh
Oscar M. Gunderson
D. Grant Mickle

Sub-Committee for Convention Arrangements

William R. Abbott, Chairman
John H. Gallagher
Ralph Michel
Victor Hofer
Robert Nau

Sub-Committee for Headquarters

Harry H. Harrison, Chairman
Lloyd M. Braff
Warren E. DeYoung
Bernard C. Hartung

Sub-Committee for Banquet

Merwyn A. Kraft, Chairman
William C. Brandes
Wilbur S. Smith
Guy Kelcey

Mr. Barton and Mr. Mitchell believe it would be of great assistance to them if every member of the Institute would take some time right now to seriously think through his idea of what the annual program should comprise. What subjects do you want to have discussed? What form of meeting do you like—panels, reports of personal experience with certain techniques, discussions of theory, debates, illustrated talks? Specifically what speakers would you recommend for inclusion on the program? Please send your replies to Robert A. Mitchell, City Traffic Engineer, 790 City Hall, Philadelphia, Pa.

Publications Received

The Institute wishes to acknowledge the receipt of the following publications:

"Report of the Committee on Traffic, Municipal Division, American Road Builders' Association." This is a 23 page mimeographed report covering accident reporting, street traffic control signs, street lighting, street land markings, pedestrian accidents, parking, off-street parking, regulation of deliveries, enforcement, and education. Mr. Harry Stedman (Assoc. I.T.E.) is chairman of the Committee on Traffic, Municipal Division.

"Roadside Development." Reports on roadside development by the Joint Committee of the Highway Research Board and the American Association of State Highway Officials presented at the Nineteenth Annual Meeting of the Highway Research Board. This is a 63 page mimeographed report, priced at 50 cents.

"1939 Traffic Accident Experience of the State of Rhode Island." This is an annual statistical report presented by the Executive Department of the Registry of Motor Vehicles of the State of Rhode Island. It is a 30 page mimeographed report containing tables, charts, and graphs to support the conclusions reached by the Research Division.

"Report of the Proceedings of the First Annual Conference of the Institute of Traffic Officers of South Africa." This is a 33 page mimeographed report covering the papers presented at this First Annual Conference of the Institute of Traffic Officers of South Africa.

Traveling Backward

A Massachusetts community recently appropriated $50.00 to make one of its streets bumpy as a cure for speeding.

Such road work, proponents claimed, would force automobiles to proceed at a slow rate of speed, thus insuring the safety of children in the neighborhood. The appropriation was passed at a town meeting only after long and heated debate, during which opponents raised the legal question of liability for damage to automobiles hitting the artificial bumps.

Texas Safety Conference

The Texas Safety Conference was held April 16 and 17 at the State Capitol Building, Austin, Texas. The following papers were presented by Institute members:

"Safety a Factor in Civilization," by Dr. Miller McClintock

"Pedestrians Represent 39 Per Cent of Deaths—What Can Be Done About it?", Sidney J. Williams

"Speed," D. Grant Mickle

"Co-ordination between Police, Prosecutor and Court," Frank M. Kreml

"Why a Community Safety Organization," Sidney J. Williams

"Uniform Traffic Control Devices and Practices For All Cities," Robert O. Swain

"Remedial Measures Through Accident Studies," Walter Klapproth

The Conference held two Engineering and Enforcement sessions—one on Tuesday and one on Wednesday. They were reported to have been exceptionally well attended.

Activities of Members

James Stannard Baker (Assoc. I.T.E.) has been appointed one of the judges in the "Good Drivers League" contest sponsored by the Ford Motor Company.

Hawley S. Simpson (President, I.T.E.) is one of the judges in the Pedestrian Protection contest of the American Automobile Association.

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Short Courses at Knoxville

The National Institute for Traffic Safety Training, conducted the past two years at the University of Michigan for persons interested in all branches of traffic safety, will be held August 12-24 at the University of Tennessee in Knoxville.

Two-week courses will be offered in traffic engineering, traffic officer training, safety education in elementary schools, safety education in secondary schools and advanced methods of adult driver training.

One-week courses will deal with vehicle fleet safety, safety organization and public education and traffic accident reports and records.

A new one-week course will be "Traffic Safety Fundamentals." This course is intended to provide a broad background for those who want a general course in traffic safety. It will show how each field of activity fits into the general picture.

The Institute's Administrative Committee consists of Dr. James D. Hoskins, president of the University of Tennessee, honorary chairman; Miller McClintock, (Mem. I.T.E.), director of the Yale University Bureau for Street Traffic Research, chairman; Norman Damon, director of the Automotive Safety Foundation; Lt. F. M. Kreml, (Affil. I.T.E.), director of the Northwestern University Traffic Institute; Burton W. Marsh, (Mem. I.T.E.), director of the Safety and Traffic Engineering Department of the American Automobile Association; and Sidney J. Williams, (Mem. I.T.E.), director, Public Health Division, Na-

tional Safety Council, executive secretary.

Ex-officio members are Prof. N. W. Dougherty of the University of Tennessee, and Prof. John S. Worley of the University of Michigan.

The Institute of Traffic Engineers has accepted an invitation to serve as one of the sponsoring organizations.

Inquiries may be addressed to Sidney J. Williams, National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

Foreign Drivers on South Carolina Roads

Exploding a popular theory that out of state drivers and vehicles contribute heavily to traffic accidents in South Carolina, the State Highway Department today released results of a special summary on highway travel and accidents in 1939.

"When accidents involving out of state drivers and vehicles are related to their exposure in terms of vehicle miles traveled, it is found that they have an even better record than that of our own drivers and vehicles," said Wilbur S. Smith, (Assoc. I. T. E.), traffic engineer of the department. "They do not play an outstanding role in accidents on state highways in South Carolina.

Although motorists from other states drove 18 per cent of the total mileage of travel on the highways, they constituted less than 14 per cent of all drivers in accidents. Their record was even better in fatal accidents, as 11 per cent of the drivers were from other states.

Passenger cars and trucks registered in states other than South Carolina together traveled 18 per cent of the total mileage operated. They comprised 16 per cent of all vehicles in accidents, and 14 per cent of the vehicles in fatal accidents.

Out of state trucks traveled 15.5 per cent of the total truck mileage and made up 14.6 per cent of the trucks in accidents. In fatal accidents they constituted 13.7 per cent of all trucks involved.

Most common state registrations of vehicles involved in accidents, other than South Carolina and the states bordering on it, were New York, Virginia, Pennsylvania, New Jersey, Massachusetts, and Connecticut.

"These figures do not include any accidents or travel in towns or cities of more than 2,500 population, as the mileage could not be obtained for city traffic, said Traffic Engineer Smith. "However, the greatest part of tourist or out of state driving is on state highways, and we feel that this comparison of South Carolina and other traffic is made on the soundest basis."

Mileage figures used in the summary were made available from data collected by the Highway Planning Survey.